GL04395_3

R. F. SMITH CORP.

EXLOG SMITH GEOTHERMAL DIVISION

GEOTHERMAL DATA LOG

COMPANY Northern California Power Agency
WELL N-4
FIELD Geysers/Castle Rock Springs
COUNTY Sonoma STATE California
LOCATION Sec. 3 T10N R8W
ELEVATION 2790' KB ☒ DF ☐ GL ☐
CONTRACTOR/RIG N.C.P.A. Rig #1
SPUD DATE Oct.26,1987 TD DATE Dec.2,1987
TD 8335' TRUE VERT DEPTH 8125'
BOTTOM HOLE LOCATION 1318'South, 274'West
WELL STATUS
COMPANY REPRESENTATIVE A. Quinn

LOG INTERVAL

DATE LOGGED Oct. 31, 1987 to Dec. 2, 1987
DEPTH LOGGED 1020' to 8335'
MUD DRILLING 1020' to 2602'
AIR DRILLING 2602' to 8335'
TEMPERATURE INSTRUMENT TYPE T Thermocouple
PRESSURE INSTRUMENT TYPE Silicon Chip
GAS TRAP-AGITATOR ELEC ☐ AIR ☒
LOG SCALE 1:600 UNIT NO. 322
LOG PREPARED BY L. Drake, A. Hernandez

HOLE SIZE		CASING RECORD	
26"	to 298'	20"	at 298'
17½"	to 2410'	13 3/8"	at 2410'
12¼"	to 6885'		at
8 3/4"	to 8335'		at
	to		at
	to		at

STEAM ENTRIES

2957'-0psi,55°F	5594'-2psi,2°F
2982'-0psi,5°F	5819'-2psi,2°F
3340'-0psi,33°F	5841'-4psi,8°F
3372'-0psi,4°F	5862'-9psi,15°F
5440'-2psi,1°F	

*= TESTED ZONES

WATER ENTRIES

*= TESTED ZONES

LOST CIRCULATION ZONES

2585'

MISC. REMARKS

Set EZSV plug & milled a window in 13 3/8" csg to fork hole. See data log N-4, Redrill #1.

LITHOLOGY SYMBOLS

- Graywacke Type 1
- Graywacke Type 2
- Graywacke Type 3
- Graywacke Siliceous
- Sandstone
- Siltstone
- Claystone
- Shale or Argillite
- Chert
- Limestone
- Solution Deposit
- Mineralized Zone
- Peridotite
- Serpentine
- Schist
- Acidic Volcanic
- Intermed Volcanic
- Basalt or Greenstone
- Melange
- Quartz Tourl
- Felsite

SECONDARY MINERALS
Q = QUARTZ
C = CALCITE
P = PYRITE
E = EPIDOTE

NB	NEW BIT	W	MUD DENSITY
RRB	RE-RUN BIT	V	FUNNEL VISCOSITY
CB	CORE BIT	PV	PLASTIC VISCOSITY
WOB	WEIGHT ON BIT	YP	YIELD POINT
RPM	REVS PER MINUTE	F	FILTRATE API
SPM	STROKES PER MINUTE	FC	FILTER CAKE
CFM	CUBIC FT PER MINUTE	SOL	SOLIDS %
NR	NO RETURNS	SD	SAND CONTENT %
C	CARBIDE TEST	S	SALINITY- PPM Cl
LAT	LOGGED AFTER TRIP	CA	CALCIUM- PPM Ca
BHT	BOTTOM HOLE TEMPERATURE	RM	MUD RESISTIVITY
TC	TIME SINCE CIRCULATION		WIRELINE LOG RUN
	CASING SHOE		WATER/STEAM ENTRY
	CORED INTERVAL		ORIFICE/FLOW TEST
	NO RECOVERY		

LITHOLOGY DESCRIPTION AND REMARKS

Note: Drilled to 314' w/ 17½" bit & 26" hole opener 16' above bit. Set 20" csng @ 298'. Drill ahead w/ 17½" bit. Begin logging from 1020' on October 31,1987.

Greenstone: pred lt grn, mnr grn, loc v lt grn, loc bleached app, pred aphan tex, tr amyg tex, loc highly silic, loc r epid along vis slicks.

Melange: 40% Greenstone: 30% Serpentine; mnr Blueschist; 30% Argillite.

Greenstone: pred med grn lt grn, mod hd-hd, pred str relict tex, aphan-fn porph, loc com slicks & mnr-abun Serp altrn.

Serpentine: lt grn-grn, sft-loc hd, pred trnsl, pred sheared, loc rexln, mnr-abun mag, mnr chrom, mnr lt blu talc, tr blueschist, mnr-com clay.

Serpentine: lt grn, grn, wht, buff, sft-hd, trnsl-opq, sheared-rexln, loc as chlor schist, com waxy, com mott app, mnr-com mag, tr-mnr chrom, intercal Blueschist, Greenstone & Argillite.

Argillite: dk gry-blk, sft-mod hd, brit, v hi sheared w/ abun calc/silic bndng, pred gd phyll sheen w/ tr mot app.

Argillite: pred dk gry, med gry-blk, mod-gd phy shn, mod hd, fol, in pt slty-sndy & grdg to Grywcke#2.

Quartz: wht, v hd, brit, mass, com fn clr qtz vn, tr chlor vn, intercal w/Greenstone.

Greenstone?: buff-lt tan, mod hd-hd, hi sheared, fol-mass tex, com mott app, com serp alt w/ intercal grn brn Serp.

Argillite: dk gry, mnr blk, mnr med gry, pred mod hd, loc v silic, gd phyll sheen, mnr slty, tr intercal Grywcke#2 clasts.

Graywacke: (Type 2) med gry-gry, pred hd, pred gd fol, mnr sl bndng, loc slty, pred mod argil, mnr-com calc/silic vng.

Graywacke: (Type 2) pred gry, mnr med gry, hd-v hd, gd fol w/ sl incr bndd app, cont mod argillaceous, w/ loc mnr intercal Greenstone & Serpentine.

Argillite: pred dk gry, blk, hd, brit, fol, mod phy shn, abun slty app, abun wht qtz vng, tr-mnr clr qtz.

Graywacke: (Type 2) lt-med gry, v hd, str mafic gr lin, s & p tex, mod rexln, fr-pr gr bndrs, incr schistose mafics w/depth.

Argillite: gry-blk, sft-mod hd, cataclastic tex-gd phyll sheen, com qtz bndg loc w/ microfolds.

Chert: org-lt grn, tr gry, v hd, hi frac, w/ v abun qtz vng, pred mylonitic tex & intercal w/Greenstone: lt grn, mylo tex, mod hd-v hd, v silic, tr clr euh qtz, mnr phyllite.

Graywacke: (Type 2) med gry, mod-hi argil, hi frac & intercal w/Argillite & argil frags.

Chert: pred orng, mnr lt-med grn, v hd, fr-gd relict tex, abun fract w/wht-clr qtz vng, tr-mnr red phyllite, mnr-com Grnstn.

Argillite: dk gry-blk, mod hd-hd, mod phy shn, sl rexln, com slty app, fol, abun intercal qtz, tr pyr, loc r tr calc.

Argillite: dk gry-blk, mnr lt gry, mod hd-hd, tr sft, pred gd phyll sheen, sl rexln w/ com sericite assoc w/ qtz vng, mnr slty app, mnr-v abun intercal wht-tr clr qtz vng, r-tr pyr, r pyrr, loc tr epid & chlor, r calc.

Graywacke: (Type 2) lt-med gry, mnr gry, hd, sl rexln w/ pred gd fol tex, com sl bndd app, mod-hi argillaceous, r arsenopyrite, r chlor.

Graywacke: (Type 3) lt-med gry, hd-v hd, pred mod-v argil, fol, mod schistose mafics, micus app, abun intercal & vn milky qtz, tr-com euh qtz, absnt-r tr calc loc r tr vn epid.

Quartz: wht, com clr, mass, com euh clr, abun fract loc r tr calc, tr-r tr pyr, r tr slicks.

Argillite: pred dk gry-blk, fr-gd phy shn, fol, sl-mod rexln, loc com-abun slty-sndy, in part grdg to Grywacke.

Note: Drilled 17½" hole to 2410'. Set 13 3/8" csng to 2410'. Drill ahead on mud w/ 12¼" bit.

Note: Began losing approx 90bbls/hr @ 2585' while doing directional work f/2540' Ream out Turbo Drill run, lay down mud pipe & rig up to air.

Quartz: wht, tr-mnr clr, tr euh, pred mass, hi frac, tr epid, tr pyr.

Chert: lt org, mnr org, tr-mnr lt grn, mnr wht, pred brecciated tex, com lt-v lt grn phyll.

Argillite: pred dk gry, mnr blk, mod hd, sl rexln v fol, mod-str phy shn, mnr slty, abun intercal mlky qtz, r tr-tr pyr.

Graywacke: (Type 3) wht-lt gry, v hd, v silic, v rexln, absnt-pr relict tex, com schistose mafic inclu, loc r tr epid, con't tr Chert.

Quartz: pred wht, mnr-com clr, v hd, pred mass com intercal w/lithic, occ sl mott app.

Argillite: pred dk gry, mnr-com blk, mod hd-hd, sl-mod silic, fr-gd phy shn, sl rexln, fol.

Quartz: pred wht, mnr-com clr, tr-mnr euh clr fract fil, pred mass.

Note: Poss v sl steam entry @ 2957'. 55°F incr, 0 psi incr. Poss v sl steam entry @ 2982'. 5°F incr, 0 psi incr.

Graywacke: (Type 3) pred wht, mnr gry, com v sl grn cast, v hd, rexln, v silic, tr arg, com app v fol, r-tr epid vng, r-tr ax vng, tr-mnr intercal Greenstone & loc Chert, v lt grn phyllite.

Note: Change in secondary minerals column. Substitute x = axinite for c = calcite.

Greenstone: pred wht-lt grn, str blchd app, mod hd-hd, com mott, pr relict tex, com fol, tr-mnr serp altrn.

Graywacke: (Type 3) pred wht, mnr lt gry, tr-mnr lt grn, v hd, v rexln, pr-absnt relict tex, com fol, v silic, str sucr tex & frstd app, abun mlky wht & clr qtz vng, r tr-str tr epid, loc tr-str tr ax, tr chlor, tr pyr.

Greenstone: wht-lt grn, hd, v blchd app, pr relit tex, tr-mnr vis relict felds, mnr-com fol, loc decr serp altrn.

Note: Very sl steam entry @ 3340'. 33°F incr, 0 psi incr. Poss v sl steam entry @ 3372'. Gradual 4°F incr, 0 psi incr.

Graywacke: (Type 3) pred wht, mnr lt gry, mnr lt grn, mod-v rexln, pred ext silic, mnr argil, pred mass, mnr fol, v sucr & frstd app, pred absnt relict tex, loc tr Serp, str tr chlor, absnt-r tr epid, tr pyr.

Graywacke: (Type 3) pred wht w/ com-mnr v sl grn cast, mnr lt gry, tr lt grn, v hd, rexln, v silic, sl arg, fn fol tex, mnr frstd app, tr-mnr mot app, mnr intercal Greenstone, com-v abun clr qtz, tr-mnr actinolite.

Graywacke: (Type 3) wht, mnr v sl grn cast, hd-v hd, rexln, silic, tr argl, tr-mnr act, r chlcopyr, decr ax, abun clr qtz, loc trnsl, lt brn mnrl, r v fn tourl.

Graywacke: (Type 3) pred wht, loc mnr incr lt gry, v rexln, v silic, pred mass, tr-mnr fol, str frstd & sucr, abun blchd app, abun mlky & com clr qtz, tr chlor, absnt-r tr epid.

Graywacke: (Type 3) pred wht, mnr-com lt gry, tr-mnr lt grn, v silic, v rexln, absnt-pr relict tex, pred mass, mnr-com fol & schistose, v sucr & frstd app, r tr-tr pyr, tr-str tr chlor.

Graywacke: (Type 3) pred wht, sl incr lt gry, tr-mnr lt grn, hd-v hd, v silic, v rexln, pred fn fol tex w/ sl schistose app, sl incr Argl, mnr-com act, r chlcopyr.

Graywacke: (Type 3) wht, tr-mnr lt gry, v hd, v silic, v rexln, decr Argl, pred mass, sucr & frstd app, mnr fol vis, tr act.

Graywacke: (Type 3) pred wht, loc tr-comlt gry, tr-mnr lt grn, v hd, v silic, v rexln, pred absnt relict tex, pred mass, locmnr-com fol w/ gneisic tex, v sucr & frstd tex, abun wht-clr qtz, r tr-tr pyr, absnt-r tr epid.

Greenstone: wht-lt grn, com bleached app, mod hd-v hd, com vis fol, com fn mot app, v rexln, v silic, tr-com act.

Graywacke: (Type 3) wht, tr-mnr lt grn, v hd, v silic, v rexln, mnr fn fol vis, com sucr & frstd app, abun clr qtz, r ax, r epid.

Greenstone: wht-lt grn, loc tr-mnr lt purp, tr grn brn, mod hd-v hd, pred fol tex, mnr-com fn mot app, rexln, v silic, mnr-abun act, r-tr tourl r-tr chlor.

Graywacke: (Type 3) pred wht, tr-mnr lt gry & lt grn, v hd, ext silic, opq-trnsl, pred mass, loc mnr-com fol & schistose, str frstd & sucr app, absnt-str tr actin, loc r tr tourl, r tr pyr, tr blk mafic disem mnr, com-abun mlky-clr qtz, r tr euh qtz.

Graywacke: (Type 3) wht-trnsl, v hd, v silic, v rexln tex, tr-mnr fol vis w/ arg incl, pred mass app, mnr schistose app, com frstd, mnr sucr app, tr tourl.

Greenstone: pred wht, loc sl grn cast, loc com lt brn, hd-v hd w/ loc tr vis microfracs, v rexln tex, v silic, com mott app, mnr sl fol app, pred bleached app, mnr-abun tourl.

Graywacke: (Type 3) wht-trnsl w/ abun clr, v hd, v silic, v rexln, com sucr & frstd app, loc mnr blk-dk grn-blu grn tourl, pred sl arg.

Graywacke: (Type 3) pred wht, mnr-com lt grn, r lt gry, ext silic, pred qtz & felds, mnr mot app str sucr & frstd app, pred mass, pred absnt relict tex, loc tr relict s&p tex, str tr-com actin, tr-com tourl, ov'all fn cut size.

Greenstone: pred lt grn, mnr grn, mnr wht, tr lt purp, mod hd-v hd, rexln, com fol tex vis, pred v silic, com-v abun act, mnr-loc com tourl, com-abun blk, microxln mnrl w/ metallic luster.

Tourmaline: blk-brn, com-abun dk grn, r-tr blu, microxln-cryptoxln agg dissem, pred anhedral, mnr subhedral aggs, loc tr euh.

Graywacke: (Type 3) pred wht, com-abun lt grn, v silic, v rexln, str sucr & frstd tex, mass, gran app, com actin, tr-str tr epid.

Greenstone: pred lt grn, mnr wht-med grn, v hd, v silic, absnt-pr relict tex, tr-com fn mott w/ relict felds, mass, gran app, tr-mnr fol, loc tr serp altrn, com-abun wht-clr qtz, tr epid, com-abun tourl.

Greenstone: lt grn-grn-grn/brn, mnr wht, tr lt purp, mod hd-v hd, sl-loc well srptnzd, mod-v silic, rexln, mnr-com fol tex, com fn mott app, mnr-com tourl.

Graywacke: (Type 3) pred wht, com-mnr lt grn-sucr [illegible]

[illegible]

[illegible]

Greenstone: pred med grn lt grn, wht, mnr lt-med brn, v hd, [illegible] silic, [illegible] rexln, absnt-pr relict tex, [illegible] pred mass, microxln, abun actin, com-abun milky-clr qtz, tr-str tr epid, r tr-tr pyr.

Steam Entry @ 5440'. Initial 2 psi & 1°F incr. Stable @ 1 psi & 1°F.

Graywacke: (Type 3) wht/trnsl-wht, com-abun clr, loc com brn/trnsl, v hd, rexln, loc sl fol vis, v silic, com sucr & frosted app, v abun tourl vng, tr epid vng.

Note: Steam entry @ 5594'. Initial 2 psi & 2°F incr. Stable @ 0 psi & 2°F.

Greenstone: lt-med grn, wht, lt-med brn, v hd, mod-v silic, v rexln, pred mass, microxln-gran app, r-mnr relict tex, abun actin, tr-abun tourl, pred absnt epid, r tr-tr pyr.

Graywacke: (Type 3H) lt-med brn, wht, transl-opq, v silic, v rexln, absnt relict tex, gran app, v sucr & frstd.

Steam Entries: 5819'; Initial 2 psi & 2°F incr. Stable @ 1 psi & 1°F. 5841'; Initial & stable @ 4 psi & 8°F.

Steam Entry: 5862'; Initial 9 psi & 15°F. Stable @ 8 psi & 14°F.

Greenstone: pred wht, lt-dk grn, ext rexln, ext silic, pred absnt relict tex, mass, sucr & frstd, abun actin & tourl.

Graywacke: (Type 3H) pred brn w/ com wht/trnsl, v hd, ext rexln, ext silic, mass, sucr & frstd app, mnr blk tourl.

Greenstone: wht-lt grn-grn, com lt purp loc, brn com-abun trnsl, mod-v silic, rexln, com fol tex, loc trnsl wht-lt brn w/ wht incl w/ fr-gd lin, loc tr chlor schist, com-abun tourl vng, mnr-v abun actinolite.

Graywacke: (Type 3H) lt-med brn, wht, transl-opq, v hd, ext silic, v rexl mass, gran app, sucr & frstx, com mot app.

Greenstone: wht, lt grn, tr-mnr med-dk grn, lt-med brn, mot-v rexln, v silic, pr-absnt relict tex, loc mnr-com vis mott w/relict felds, abun-com actin, loc tr-str tr Serpentine.

Greenstone: mod-dk gry, gry/brn, lt-med brn, wht lt-med grn, absnt-gd relict tex, mod-v rexln sl-v silic, tr-mnr sft w/serp altn-v hd, pred mass, tr-mnr fol, tr-str tr disem blk mnrl, r tr-tr pyr, absnt-r tr epid, tr-abun wht-clr qtz.

Greenstone: lt grn-wht, tr-mnr brn, r-tr purp, rexln mot tex, v silic, aphan-microxln, pred mass app, mnr-com act, r pyr, r epid, r-mnr clr qtz, intercal Graywacke: (Type 3H).

Greenstone: grn-wht-lt grn-brn, mnr purp, v hd, v silic, v rexln, mnr-com fol tex, com-abun mot app, loc tr serp altn, tr-com tourl, decr act, incr pyr & epid, poss tr chlor.

Graywacke: (Type 3H) lt-med brn, wht, v silic, v hd, mnr bnd app, v sucr & frstd, pred mass, gran app, r tr pyr.

Note: Apparent drill break @ 6683' & @ approx 30' intervals below attributed to slugging the hole w/ 5bbls of water every kelly to eliminate fill on connections.

Graywacke: (Type 3H) brn-med brn, com dk brn, tr-mnr wht/trnsl, v hd, exr rexln, ext silic, pred sucr tex w/ glassy luster, tr v fn dissem pyr, tr-mnr epid vng, intercal Greenstone: grn-lt grn/clr, v hd, ext rexln, ext silic, pred gran app, loc glassy luster, mnr-com tourl.

Note: Drld 12¼" hole to 6885'. Due to fill problems change over to 8 3/4" bit.

Graywacke: (Type 3H) lt-med brn, clr-wht, mnr dk brn, ext silic & rexln, str gran app, r tr epid r tr pyr, tr-absnt cholr schist.

Graywacke: (Type 3H) lt-med brn, med-dk gry, dk brn, wht, lt-med grn, ext silic & rexln, v hd, str gran microxln tex, high vit lustr, abun dk gry-blk fn gr tourl aggs.

Note: Twisted off while drilling @ 7072'. Top of fish @ 2515'. Retrieve fish on first try w/overshot.

Graywacke: (Type 3H) pred wht, transl-opq, lt-med mott brn, lt-med grn, ext silic, v hd, ext rexl tr-str tr epid, loc r tr axinite, abun clr qtz.

Greenstone: pred grn, tr-mnr lt grn, v hd-incr mod hd-hd, pred v silic, pred ext rexln, pred gran text w/ incr fol tex, comloc mot app, mnr-com act.

Graywacke: (Type 3H) brn/trnsl/clr, mnr opq/wht, mnr clr w/ blk, v fn, disem mnrl, v hd, ext rexln, mnr vis fol, loc sl schistose tex.

Graywacke: (Type 3H) pred clr-wht w/lt-med brn mott, ext rexln contact metmorphic, v abun water clr qtz, tr epid, loc r tr brn mica.

Tourmaline: dk gry-blk, v fn-fn gr, pred mass aggs, tr-com disem xls in clr qtz.

Quartz: clr, wht, transp-opq, v hd, conch fract, mass, com mott app, tr-str tr epid, tr poss grn epid or grn tourl, v fn cut size.

Felsite: wht/clr, v hd, gran tex, tr-mnr brn mica, tr grn mica, r-tr blk acic xls, tr vis stria.

Note: Poss steam entry @ 7515'. Initial 6 psi & 0°F incr. stable @ 0 psi.

Felsite: wht/clr, v hd, gran tex, tr-mnr brn mica, tr grn mica, 40-80% clr qtz & clr felds, tr xl faces w/ stria, r blk acic xls.

Felsite: pred clr, wht, qtz & felds, com clr w/ striations, tr-str brn mica, r tr-tr blk acic in clr qtz, felds, & occ in epid, r tr-str tr chlor, absnt-tr actin.

Felsite: pred clr, com wht, pred qtz & felds, tr-mnr brn mica, tr blk disem acic xls, v hd, gran tex, com vis xls w/ stria, tr well chlortzd mica.

Felsite: pred as above w/ sl incr brn mica, sl incr chlor, sl incr blk acic xls in clr qtz, r epid.

Felsite: 70-80% clr, wht, r tr-tr brn mica, absnt-tr chlor, r tr blck acic xls, gen'ly decr sec mnrls, absnt-r tr epid, absnt-r tr poss grn tourl.

Felsite: 70-90% clr, transl-opq wht, pred a/a, tr-str tr brn mica absnt-tr epid, r tr-tr flake chlor, com clr frags w/stri, absnt blk acic xls, com contam from beneath muffler & sample ditch.

Felsite: pred clr, wht, pred a/a, tr brn mica, r tr-tr chlor, r tr-tr epid, con't sple contam v fn cutting size.

Felsite: pred clr, com wht trnsl-opq, mnr-com brn mica, loc abun, r sl chlortzd felds, mnr-com clr frags w/ stria, r-tr blk acic xls, r poss grn tourl, pred r epid, tr flake chlor, mnr-com contamination.

Note: Drilled 8 3/4" hole to a total depth of 8335' on December 2, 1987.

REMARKS - LITHOLOGY
EXLOG/SMITH